VOLUME 76 SEPARATE No. D-XIX

PROCEEDINGS

AMERICAN SOCIETY
OF
CIVIL ENGINEERS

JULY, 1950

DISCUSSION OF ROADS AND PAVEMENTS, SAMPSON NAVAL TRAINING STATION

(*Published in October, 1949*)

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HIGHWAY DIVISION

Headquarters of the Society
33 W. 39th St.
New York 18, N.Y.

PRICE $0.50 PER COPY

1620.6

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DISCUSSION

P. F. PHELAN,[5] ASSOC. M. ASCE.—The design and construction of the roads and pavements at the Sampson Naval Training Station in New York are treated clearly and concisely in this paper. To those engaged in bituminous mix design, or in the inspection and control of bituminous mixing plants, it might be of interest to discuss more fully the design of the tar concrete mixtures and compare these design mixes with those actually obtained.

Based on gradations of the aggregate materials available in the stone quarry, the sand pit, and the mixing plant stock piles, the aggregates were fed into the premix plant in the proportions shown in Table 2. The batch mixing formulas, based on the gradations of materials in the hot aggregate storage bins of the plant, were shown in Table 1. Listed in Table 3 are the preliminary binder and top course design gradings, together with the actual gradation ranges and the average gradings obtained during the 1942–1943 seasons. The data in Table 3(*a*), for the binder course refer to the denser binder mix used after November 19, 1942 (see Table 1).

TABLE 2.—AGGREGATE PROPORTIONS AT THE PREMIX PLANT

Material	Nominal size (in.)	Binder (%)	Top (%)
New York State Department of Public Works Size:			
No. 2	1 to ½	60	....
No. 1	½ to ¼	20	15
No. 1A	¼ to ⅛	20	35
Stone screenings	....	....	35
Concrete sand	....	....	15
Total		100	100

Study of the data in Table 3 shows that the average mix gradings obtained in 1942 and 1943 were very close to the preliminary design gradings. It also indicates that the variations in gradation from the average were quite small, the actual gradation ranges being quite narrow. The average mix gradings, based on daily analyses of aggregate samples from the plant bins, together with the tar concrete specification limits, are plotted in Fig. 7. It is of interest to note that the average mix gradings for the two seasons are practically identical.

It is somewhat novel in the writer's experience to find a premix project of this size (75,000 tons) where the preliminary mix designs (based on samples of aggregates from the quarry and the pit stock piles) were so closely adhered to after the aggregates had been loaded into trucks or rail cars, transported to the mixing plant site, unloaded into stock piles, proportioned into the plant feeder, dried, and then screened into the various plant hot storage bins. It is also

NOTE.—This paper by Jacob Feld was published in October, 1949, *Proceedings*. The numbering of footnotes, tables, and illustrations in this Separate is a continuation of the consecutive numbering used in the original paper.

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somewhat unusual to find a premix plant producing mixtures of such uniform gradation throughout a 5-month construction schedule at the rate of more than 100 tons per hr, especially where three or four aggregates are being proportioned into the plant. The results are indicative of efficient plant operation and competent inspection.

Fig. 8 indicates the type of traffic to which much of the pavement has been subjected. This view, taken when the pavement was more than 5 years old, shows practically no distress after constant subjection to heavy loads; quick starting, stopping, and turning traffic; oil, grease, and gasoline drippings; etc. The base in this area was especially soft at the time when the two courses of hot lay tar concrete were placed. Immediately in front of the warehouse doors,

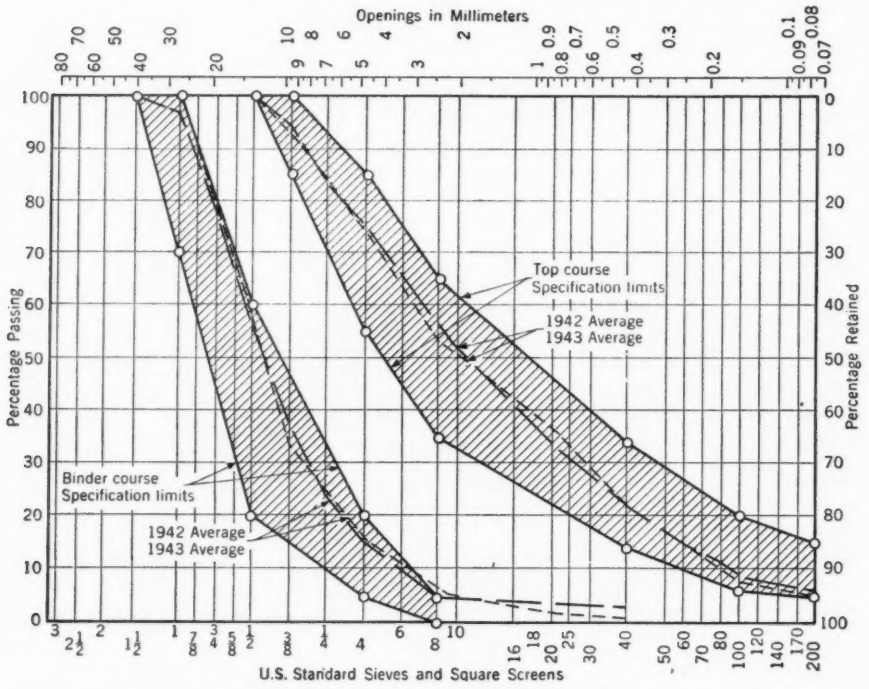

FIG. 7.—AVERAGE MIX GRADINGS VERSUS HOT LAY TAR CONCRETE SPECIFICATIONS, NAVAL TRAINING STATION, SAMPSON, N. Y.

several cracks as wide as $\frac{1}{4}$ in. and as deep as 1 in. were visible in the pavement when construction was stopped in December, 1942. The base had been too soft for adequate compaction under the roller and the mix had cracked when additional rolling was attempted after the mix had cooled. However, under traffic these "cracks" healed and have not subsequently reappeared. The writer had occasion to inspect this project in January, 1950, after 7 years, and found the roads and pavements to be in good condition, with little maintenance of any kind required. Similarly, over a large tar concrete paved area in the Navy Fire Fighters' School at Sampson, the surface was subjected to oil, grease

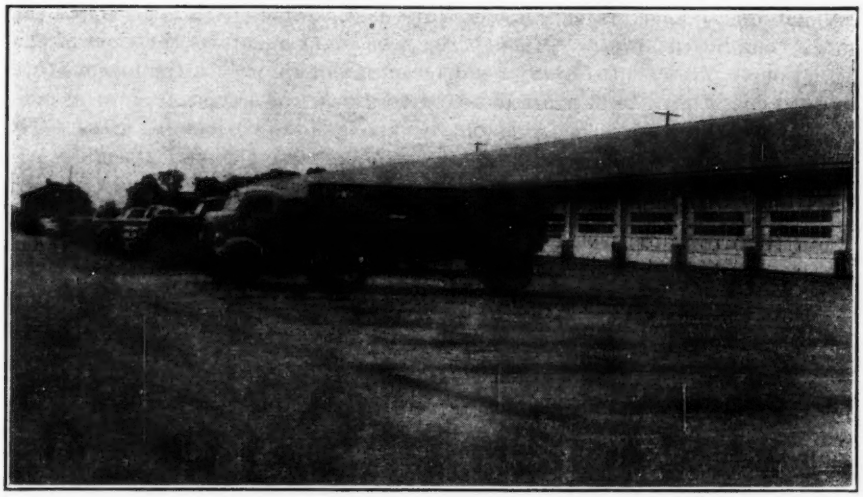

FIG. 8.—WAREHOUSE, GARAGE, AND HEAVY MAINTENANCE AREA

FIG. 9.—ONE OF THE SIX TRAINING AREAS

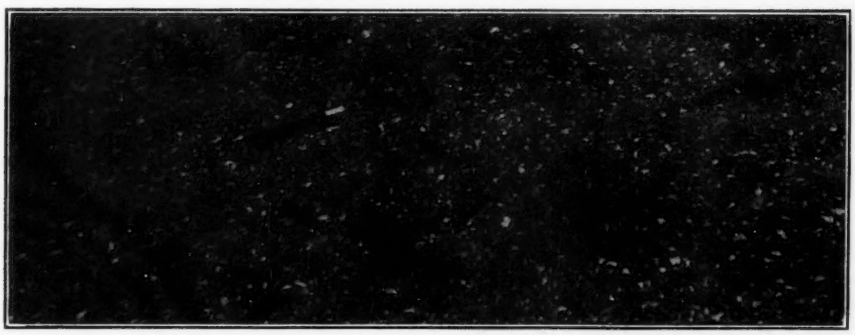

FIG. 10.—CLOSE VIEW OF PAVEMENT SURFACE IN FIG. 9

and gasoline spillage, water from high pressure hose lines, and intense heat from mock "shipboard" fires. Although the base was too soft at the time of construction to obtain satisfactory compaction under the roller, the mix was still in good condition after 4 years of use—and 2 years of nonuse.

Fig. 9 shows part of the pavement inside one of the six training areas. The primary road paving is seen in the foreground with a paved assembly area across the center of the picture—the two pavements being separated by a curb

TABLE 3.—Tar Concrete Gradations (Percentage Passing, by Weight), Naval Training Station, Sampson, N. Y.

Passing sieve:	1942			1943			Specification limits, hot lay tar concrete
	Preliminary design[a]	Actually Obtained[b]		Preliminary design[a]	Actually Obtained[b]		
		Range	Average		Range	Average	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(a) Binder Course							
1½ ...	100	100	....	100	100	100	100
1 ...	99	99–100	100	98	95–100	97	70–100
¾ ...	79	74–84	78	74	73–80	78	....
½ ...	53	54–68	58	53	48–60	56	20–60
⅜ ...	29	31–38	34	35	30–44	37	....
¼ ...	21	20–31	25	24	20–29	24	....
No. 4...	13	12–20	16	16	12–20	15	5–20
No. 8...	7	5–9	7	7	4–7	5	0–5
No. 10...	6	3–7	5	6	....	....	....
No. 20...	3	1–4	2	5	3–5	4	....
No. 40...	1	0–2	1	3	2–4	3	....
(b) Top Course							
½ ...	100	100	100	100	100	100	100
⅜ ...	93	90–95	93	95	91–99	94	85–100
¼ ...	85	82–87	84	85	79–86	83	....
No. 4...	72	66–79	74	71	66–80	75	55–80
No. 8...	51	49–62	53	57	49–64	56	35–65
No. 10...	48	45–56	51	53	46–60	52	....
No. 20...	34	30–40	37	34	29–40	34	....
No. 40...	25	17–24	22	25	19–25	22	14–34
No. 60...	17	....	....	16	12–16	15	....
No. 80...	12	7–12	10	10	7–12	11	....
No. 100...	10	5–9	8	7	6–10	9	6–20
No. 200...	5	4–6	5	6	5–8	6	5–15

[a] Based on samples from quarry and plant stock piles. [b] Actual mix gradations computed from daily analyses of plant bin samples.

made with tar concrete surface course mix. Immediately behind this paved drill area is part of a 15-acre sodded drill field.

Fig. 10 is a close-up of the road surface in the foreground of Fig. 9, showing its condition after 5 years of use. The pavement appeared to be about the same as indicated in this view when inspected in January, 1950. Although almost 8 years old, this pavement appears to have several years to go before any appreciable maintenance will be required. If it were decided to reopen the Naval Base for full-scale operation, a surface treatment might be indicated to enrich the surface of the pavement.

This paper is an excellent, complete story of the design and construction of the paving at the Sampson Naval Training Station where unfavorable soil conditions, shortage of local aggregates, and severe weather conditions were overcome to provide permanent roads, paved walks, and training areas for Navy personnel. The speed and economy with which the paving was completed are indicative of the care exercised in the planning and construction. The extremely low maintenance to date points up the adequacy of the designs adopted.

JACOB FELD,[6] M. ASCE.—Both the additional technical data on the actual mixes produced and the more recent physical inspections of the tar mix pavements contributed by Mr. Phelan increase the value of the paper as a possible guide to similar future projects. One of the more unusual pavements (which also was a part of this same project) consisted of some 4,000,000 sq ft of sod, which was produced off the site, cut, and laid all ready for use in 5 months. The methods employed and some indication of costs have been published elsewhere.[7]

Completion of work of such unprecedented character, when time does not permit any research to fill in gaps in information, requires the closest cooperation between technician, designer, and contractor. The writer wishes to give credit to all those who contributed to the successful accomplishments described in the paper.

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[6] Cons. Engr., New York, N. Y.

[7] "Sod," by Jacob Feld, *Roads and Streets*, April, 1948, pp. 84–86, 98, and 126.

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